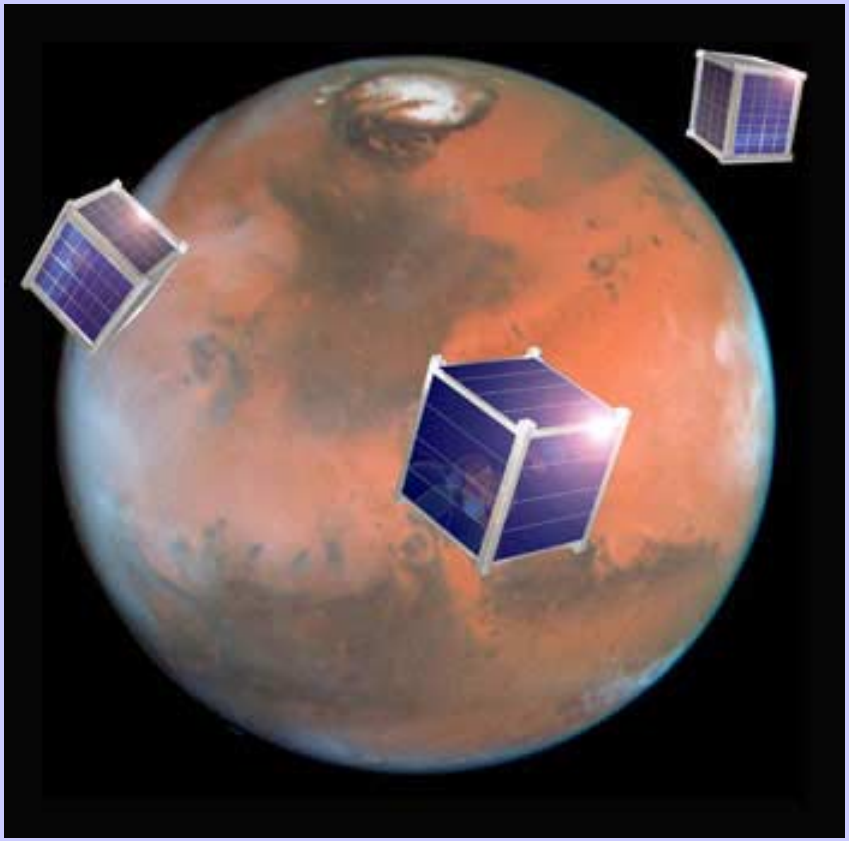
The National Space Grant Student Satellite Initiative

Mission Endorsements Sponsors Members Programs Resources



Crawl Walk Run Fly

Program Goals

- Education
- Workforce development
- Technology development/qualification
- Planetary exploration
- Outreach

Form Partnerships

Industry

Government

Universities

K-12

Start a National Competition

- Best science proposal
- Best design/documentation
- Best performance in the laboratory
- Best flight performance
- Best results/publications

Maintain a National Data Base

- Publish design of top performers
- Allow
  - Copies
  - Upgrades
  - Redesigns with better technology

That's all folks!

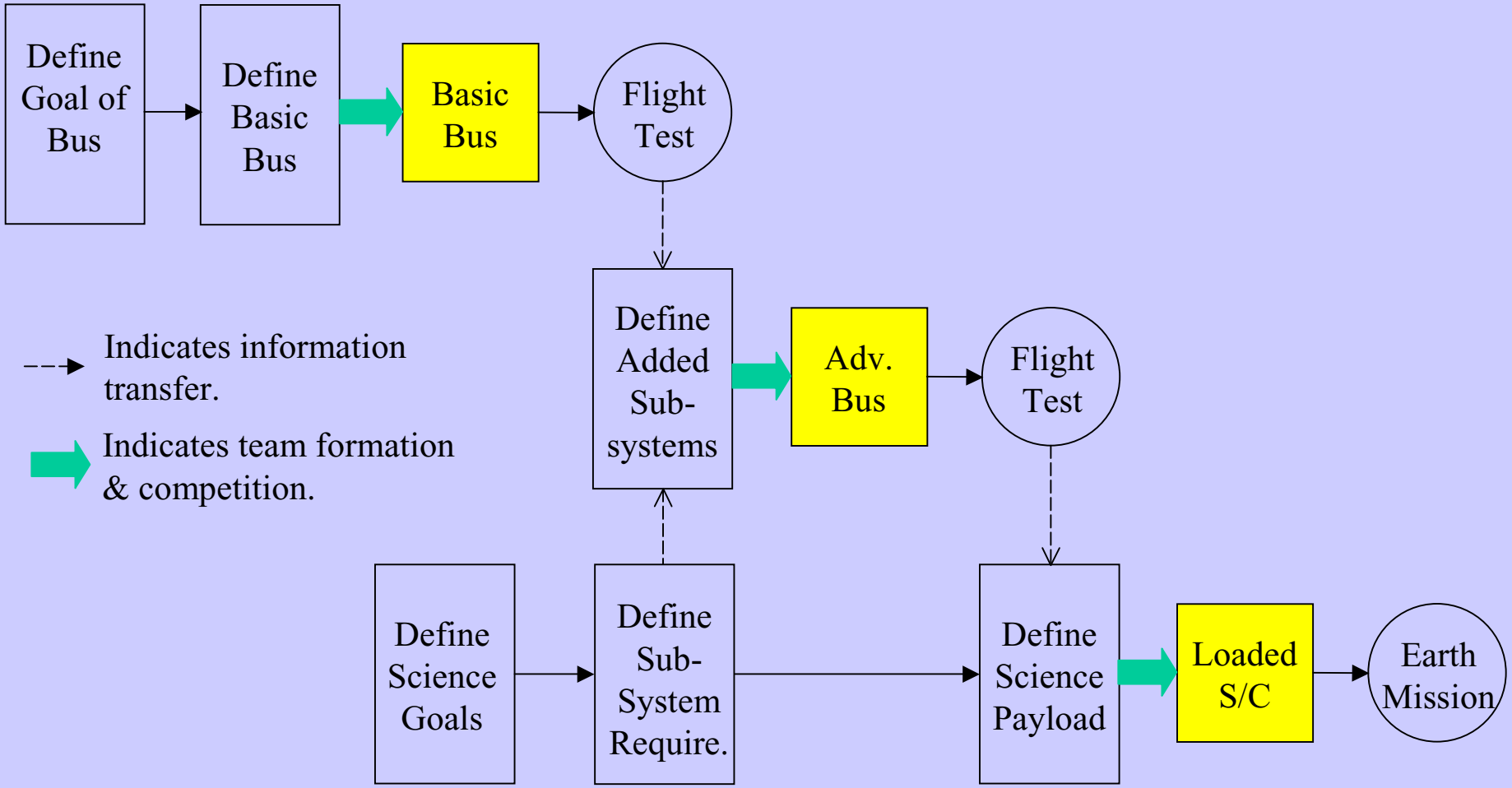
Crawl Walk Run Fly

Material for discussion

Crawl Walk Run Fly

A Roadmap for Future Space Grant Missions

Earth Missions are the Gateway to Planetary and Deep-Space Missions



Suggested by The University of Arizona Space Grant Student Satellite Program

Subsystems for an Advanced Buses

Some subsystems required for formation flight

Function	Technology	Requirement	Components	Team
Structure	LongSat	$10 \times 10 \times 10n$ cm	Design Fab. Val., Test	
Power	Solar panels	Deploy	Deployment mech.	
Stabilization	Spin Ram pressure	Spin rate, Spin attitude Math model	Spin & despin mech. Pressure vanes; control	
Attitude sensing	Ref.: Star Sun Magnetic	Accuracy, Stability, Knowledge	CMOS imager, Pin-hole; photo-diodes, Magnetometer	
Attitude control	Magnetic damper Magnetic torquer Reaction wheels Micro thrusters	Damping rate: Reaction time, Power, Torque: Reaction time, Power, Torque: Range of thrust, Power:	Bar magnets Wireloops, current source; control Reaction wheels; power source; control	
S/C ↔ ground	Optical	Availability of ground sites, Power on S/C	Laser stations; retro-reflectors	
S/C ↔ S/C	Radio Optical	Frequency, Power Beam divergence, Power	Transceivers; antennas Diodes; retro-reflectors	

Subsystems for the Basic Bus

Function	Technology	Requirement	Components	Team
Structure	Body structure	$10 \times 10 \times 10$ cm CubeSat specs.	Design, Fab., Validate Test	
Power	Solar panels	Body mount Power:	Solar Cells	
	Rechargeable battery	Power: Cycling life:	Safety Hazard	
Stabilization	Gravity gradient	Math model Mass distribution:	Ballast	
Communication S/C $\leftrightarrow$ ground	Radio	Frequencies Band widths Power	Transceiver; antenna	
Data & Command	On-shelf with flight heritage	Bit rate, Memory size Power:	Onboard computer; memories, interface	

Scientific Objective

Monitor Atmospheric & Plasmaspheric Dynamics by Remote Sensing

Daytime:

Filter photometers, forward/backward looking for tomography.

Monitor resonance scattering by atom and molecular tracers, Ca, Ca^+, Mg^+, Na., N_2^+, O^+

Nighttime:

Filter photometers, forward/backward looking for tomography.

Monitor nightglow photochemical emissions, OI(5577), OI(6300), O_2 (Atmospheric), OH(Meinel).

Plasmasphere:

Filter photometers to monitor resonance scattering by the He^+ ion.

CubeSat Requirements (besides the basic Bus):

- Gravity gradient
- Pith attitude knowledge, ± 1.0°
- Roll attitude knowledge, ± 1.0°
- More than one satellites

Scientific Objective

Detect Gravity Waves at Nightglow Altitudes

Nighttime imaging with a band pass filter to isolate the $O_2(0,0)$ emission looking down

CubeSat Requirements:

- Gravity gradient
- Time Delay Integrate (TDI) exposure control
- On board analysis

Scientific Objective

Sprite detection and analysis

Sprite imaging spectrograph to detect nitrogen emissions, N_2 first positive, N_2 second positive, and N^+_2 first negative emissions

CubeSat Requirements:

- Limb tracking using the $O_2(0,0)$ atmospheric emission layer
- On board detection and analysis
- Selected image storage

Scientific Objective

Absolute Atmospheric Density Monitor, O, O_2 and N_2

Absorption of solar flux in three band pass regions, 30 –60, 80-90 and 121.6 nm

CubeSat Requirements:

- Solar tracking
- 2 axis control, bus, mirror or both
- Control ± 2 degrees, both axes
- Attitude knowledge ± 0.5 degrees